The Effectiveness of Peer-Led Team Learning Workshops:
An Action Research Approach

by
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The Effectiveness of Peer-Led Team Learning Workshops:

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Chapter One: Introduction

Problem Statement

All college students who intend to graduate from a science program can be grouped into two categories: those who earn a science degree and those who decide to pursue nonscientific fields of study. The question that lies therein is: Why do students decide to change from a science major to another field? Also, what can postsecondary level educators do to combat these occurrences?

Significance of the Problem

According to Tobias (1990), the number of students who decide to pursue nonscientific fields “might in fact be enough to prevent the shortfall of American scientists and engineers that has been widely forecast for the coming decade” (as cited in Felder, 1993, p. 286). This second grouping of students has been thought to leave the scientific realm in pursuit of other interests because of the failures within introductory science courses. These failures include a lack of motivating interest, a passive approach to teaching, emphasis on a competitive approach instead of a cooperative learning approach, and a focus on algorithmic problem solving instead of conceptual understanding.

Despite these setbacks, college chemistry instructors have a number of course goals for their students. According to Burke, Greenbowe, and Gelder (2004), these include helping students develop a working knowledge of the course material, overcoming misconceptions, developing or improving problem solving skills instead of depending on rote memory, learning to think critically and analytically, and being
actively engaged in hands-on learning experiences. In order to help college chemistry faculty achieve these goals, and to help manage the apparent failures of science courses, curriculum reform efforts and a variety of student assistance programs are being implemented. Some of these programs are ChemConnections, Molecular Science, New Traditions, Supplemental Instruction, Emerging Scholars, Peer-Led Team Learning Workshops, and other team-based learning approaches.

**Purpose**

The student assistance program currently being implemented in the general chemistry courses at the State University of New York College at Brockport (SUNY Brockport) campus is the Peer-Led Team Learning Workshop (PLTLW) approach. The PLTLW approach was developed by the National Science Foundation and is a student-centered approach to learning course material ("Peer-led," 2005). Liu (2004) states "workshop-based instruction aims to enhance collaborative design through presentation, discussion, assessment and knowledge construction" (p. 2). PLTLW utilizes the basic principles of social constructivism, where active participation of students during instruction is a necessity. General chemistry students voluntarily meet in groups of six to eight for two hours each week in order to work cooperatively on problems that compliment the lecture and laboratory content. Students who have previously, and successfully, completed the chemistry course are invited to become PLTLW leaders. These leaders are trained to act as facilitators for the workshop, and are not there to act as lecturers or tutors (Hanson & Wolfskill, 1998).
The effectiveness of the PLTLW program, as well as other programs like it, has been a basis for study within the past decade. In a study by Gafney (2001), six higher education institutions implementing the PLTLW approach submitted the grades of students involved with, and not involved with, PLTLW. For each of the six institutions, students participating in PLTLW outperformed their non-participating peers. According to Herreid (2003), students received higher course grades and were able to learn more material and retain it better by attending the workshop sessions. However, improved course grades and content retention are not the only effects of PLTLW. The purpose of this action research is to consider additional benefits of PLTLW.

Rationale

Action research within a chemistry student assistance program is relevant to the field of science education because it is a voluntary, remedial effort supported by the science community in order to further the education of its students. It is meant to enforce concepts and allow students the further application of content taught in lectures and labs in a guided inquiry format. Action research within this context is meaningful to me because I have been leading some type of assistance, whether as a one-on-one tutor, supplemental instruction leader, or peer-led team learning workshop leader for the past four years. I believe that modification should be an ongoing process in order to improve the experience, for both the students and leaders
Summary

A student assistance program has been deemed a necessity for many general chemistry courses at the postsecondary level. The program used at SUNY Brockport is the Peer-Led Team Learning Workshop (PLTLW) model. It is being implemented in hopes of retaining students as well as to help achieve course goals by assisting in the enforcing of concepts and the application of lecture and laboratory content. The purpose of this action research was to determine the effectiveness of the PLTLW program by means of answering the following questions:

1. What is the effect of proper leader training?
2. How does PLTLW affect the leaders?
3. What are the effects of teaching problem-solving skills?
4. Does PLTLW increase student motivation within the chemistry course?

Data will be collected through student and PLTLW leader surveys, questionnaires, and an observational journal. These pieces of data will be analyzed and aid in the monitoring and adjusting of the present PLTLW format at SUNY Brockport.
What Is the Effect of Proper Leader Training?

In a study by Roehrig, Luft, Kurdziel, and Turner (2003), graduate teaching assistants (GTAs) were observed as they implemented an inquiry-based instruction approach. The results of this study helped to influence how GTAs were trained. It was determined in the study that the GTAs’ prior inquiry-based experiences affected instructional decisions; they did not have the instructional skills needed for the learning environment, and they had misconceptions about how students learn. This is not unlike the PLTLW leaders, who are also undergoing a role change from student to guide. The beliefs about teaching and how students learn are based solely on the GTAs’ (and PLTLW leaders’) previous experiences as students.

Based on the experiences and observations of Tien, Roth, and Kampmeier (2004), “the preparation of the peer leaders is key to an effective workshop” (p. 1313). PLTLW leaders are required to attend weekly training sessions that are jointly led by chemistry course instructors and education and/or learning specialists. It is within these weekly sessions that the leaders gather to work through the workshop activities themselves before they meet with the students (Lewis & Lewis, 2005). The main goal of these training sessions is to provide “a forum for discussing pedagogical ideas and practical applications to prepare leaders to facilitate student-centered instruction” (Tien, Roth, & Kampmeier, 2002, p. 607).

There are three main areas where PLTLW leader training should be focused: group work, pedagogy, and content. Group work involves the teaching of group
dynamics and skills, student motivation, and group diversity. It also involves knowing students’ learning styles and intellectual development (Gosser, Jr. & Roth, 1998). This area falls into the category of classroom knowledge, or knowing the students and the environment they are in (Tien, Roth, & Kampmeier, 2004). Given that participation in PLTLW is voluntary, there may be times when only one student attends. In this case, it is nearly impossible for the PLTLW leader to not take on the role of a tutor. In peer-assisted learning, or peer tutoring, it is important that the leader/tutor maintains a facilitating role by using error management skills. The leader should also make sure that the student is recognizing generalizations from the specific examples completed, since group members are not present to help in this process (McLuckie & Topping, 2004).

The second main area is pedagogy. Pedagogy involves using effective teaching and studying tactics based on the situation or context. The last area, content, is quite self-explanatory. Leaders must have mastery within the subject matter. Pedagogy and content fall into the category of pedagogical content knowledge, or knowing the content and how to best teach it to the students. This involves being aware of student misconceptions and other problems with the content so that they may be corrected using applicable teaching skills (Tien, Roth, & Kampmeier, 2004).

These three areas of leader training all fall under a broad knowledge descriptor known as pedagogical context knowledge. In a study by Barnett and Hodson (2001), it was determined that teaching is “a complex and subtle activity which requires many forms of knowledge” (p. 448). Pedagogical context knowledge
encompasses four types of knowledge: academic and research knowledge, pedagogical content knowledge, professional knowledge, and classroom knowledge. It is important that at least pedagogical content knowledge and classroom knowledge are taught and practiced to ensure an effective leader training program in which both the leaders and the students attending PLTLW sessions will benefit.

**How Does PLTLW Affect the Leaders?**

As stated by Tenney and Houck (2004), there are not many studies that have been done to test the effectiveness of PLTLW on the workshop leaders. Tenney and Houck, therefore, took it upon themselves to administer questionnaires and collect workshop leader reflection journals over the course of four years so as to study the impact that PLTLW has on its leaders. There were five major benefits, given in the order of highest to lowest ranking, which were determined from this study. The first was an increase in understanding the subject matter that was covered by the workshop. The second was the relationship developed with the course instructor. The third benefit was the opportunity to develop teaching skills and discover a desire to teach. The fourth was improving people skills, while the last was the monetary compensation for their involvement.

In a study by Varma-Nelson and Gafney (2002), a survey was distributed to former PLTLW leaders who had since graduated. They received sixteen responses out of the twenty-six originally mailed out. These surveys asked for graduate study and career information, as well as required responses to Likert-scaled items and open-ended questions. The scaled items and open-ended questions asked about the impact
PLTLW had on their career choices, their learning experiences, and their overall undergraduate education. The purpose of focusing this study on former PLTLW leaders, rather than current ones, was due to the idea that “perceptions of instructors, courses, and educational experiences often change as the college years recede from immediate experience” (p. 8). The researchers wanted to see the long-range outcomes of leading a PLTLW.

The scaled items involved the ranking of various undergraduate learning experiences. Experiences with the strongest impact were given a “5”, while those with no impact were given a “1.” These experiences were ranked by the researchers based on the mean score obtained from the surveys. This ranking of strongest to weakest impact is as follows: (1) acting as a peer leader for workshops, (2) independent study of assigned work, (3) participating as a student in peer-led workshops, (4) attending lectures, (5) working with a friend, study partner, or small group, (6) individual consultation with professors, (7) tutoring, (8) laboratory work, (9) independent projects, research, poster presentations, (10) off-campus meetings and conferences, (11) recitations led by graduate students. The first four experiences ranked all had a mean score between four and five, with acting as a PLTLW leader being the most valuable experience.

The responses to the open-ended questions revealed that leaders’ knowledge of chemistry was “enhanced or reinforced, and that concepts were solidified” (Varma-Nelson & Gafney, 2002, p. 8). The replies also revealed that being a leader “strengthened their interest and determination to pursue science-related careers” (p.
8), since all former leaders who responded were currently pursuing advanced education or careers related to science. The last major benefit noted by those taking part in the survey was that by being a leader, they had “improved or gained confidence in speaking and interacting with people” (p. 9). While the survey was limited in both the questioning and response level, the unanimous decision was that being a PLTLW leader was the most valuable undergraduate learning experience.

According to Watters and Ginns (1997), leaders in a program similar to PLTLW benefited from two major, positive effects. The first was that leaders gained experience in establishing a cooperative learning environment, with a main purpose of enhancing confidence and diminishing stress. The second was that “the technical skills of facilitating a group, questioning, encouraging, and scaffolding were acknowledged” (p. 7). A negative effect mentioned was a concern in the realm of time management. These results were obtained from comparing the weekly journals submitted by all of the program leaders.

Beneficial leader effects were abundant in all three of the research studies previously mentioned. While there has not been as much research in this area of PLTLW as compared to others, the results obtained have been fairly similar. There is an overwhelming amount of positive effects, and not many negative effects, for PLTLW leaders.

What Are the Effects of Teaching Problem-Solving Skills?

According to Glenn (1998), the workshop method of active learning “improves not only students’ performance in chemistry courses but also enhances
their overall critical-thinking skills” (p. 147). This is an extremely important part of the PLTLW sessions, since the course instructor may not necessarily explain the steps needed to solve chemistry problems to the fullest extent. This thought was noted by Arendale (2000), who stated that “As an instructor I sometimes spend too much time telling and not enough time modeling the thinking process for finding the answers and developing critical thinking abilities” (p.2).

Within the context of pedagogical content knowledge, leaders must be trained to model the problem-solving process as it pertains to generalized chemistry problems. This training is required because not all leaders are well equipped to articulate how they go about solving a problem. In the training guidelines given by Tien, Roth, and Kampmeier (2004), leaders discuss “the differences between expert and novice problem solvers, the use of heuristics, and unstructured and structured approaches to problem solving” (p. 1316). The main approach taught to the leaders is Polya’s problem-solving scheme. This is a four-step process that follows in the order of (1) understanding a problem, (2) developing a plan to solve the problem, (3) implementing this plan, and (4) evaluating the progress of solving the problem using the developed plan. The last step involves individual reflection and monitoring. This metacognition is a valuable aspect of developing critical-thinking skills.

Tsaparlis (2001) gives a variety of suggestions for how to improve the problem-solving capabilities of students. These include using algorithmic methods, giving a qualitative estimation, or prediction, of the result, checking the validity of the equations and relations used to solve a problem, as well as evaluating the result
obtained. An effective way for leaders to check the status of student problem-solving skills is to have each student work on a problem on his/her own, and then in groups. Tsaparlis notes that at the forefront of teaching problem-solving skills is the opportunity for students to be given ample practice in using these skills. It is only through practice that the solving of problems can be perfected and students will become more confident in their problem-solving process.

The role of the peer leader is to support the students through the problem-solving process, and not to simply solve the problem for the students. However, peer leader support is not the only factor that helps develop the students’ problem-solving skills. According to Tien, Roth, and Kampmeier (2002), the student-student interaction also plays a major role in critical-thinking skill development. Students are encouraged to think out loud, reflect on the main scientific principles that they apply, and monitor their understanding. In doing so, students articulate their thought processes with one another. Debates as to the best method for solving a problem are discussed between PLTLW members. As each student participates, his or her explanation skills are forced to develop. A more specific method of strengthening problem-solving skills is known as the pair problem-solving approach. While one student thinks out loud, another student is listening and asking questions for clarification. Another method, known as reciprocal questioning, encourages students to ask such questions as “What are you doing?”, “Why are you doing it?”, and “Where do you think it will get you?” (Tien, Roth, & Kampmeier, 2002, p. 611).
Through this student-student and leader-student interaction, problem-solving skills are strengthened.

A perhaps unforeseen benefit to developing problem-solving skills within a team-learning environment is the experience gained. According to Gardner and Korth (1997), “Organizations want people with ‘people skills,’ who can be effective team members and team leaders” (p. 45). As a result, teaming techniques in higher education are being designed in order to allow for the transition of group skills from the classroom to the workplace. By focusing on “understanding group dynamics, group development, and techniques for improving group effectiveness as members or facilitators of a team” (Gardner & Korth, 1997, p. 47), both the students and the PLTLW leaders are able to transcend their skills in their academic career and use them in their professional career as well.

Does PLTLW Increase Student Motivation Within the Chemistry Course?

According to Brophy (1988), the motivation to learn is a “student’s tendency to find academic activities meaningful and worthwhile when deriving the intended benefits of those activities” (as cited in Hancock, 2004, p. 159). While student motivation is one of the most important aspects of any learning environment, it is one of the least understood. This is due to the variety of situations and personal variables that provide an individual with the desire to fulfill a given goal. One of these variables is a personality factor known as peer orientation, or an individual’s preference to work either in groups or alone (Hancock, 2004). If a student has a strong preference to work alone, and the benefits of the PLTLW do not outweigh this
preference, then it would be extremely difficult for the student to be motivated to attend a PLTLW session. Unfortunately, research has shown that students who lack this type of academic group atmosphere will undergo more academic stress than those who participate willingly (Fantuzzo, Riggio, Connelly, & Dimeff, 1989). These are the types of motivational obstacles that need to be overcome in order for PLTLW to be effective.

Leaders must be trained to give motivational support to the students involved in the workshop sessions. The most effective method of training in this area is learning about self-determination theory. This theory is based on the social and environmental characteristics that can be either beneficial or detrimental to one’s intrinsic motivation. Tien, Roth, and Kampmeier (2004) mention three important aspects of intrinsic motivation: competence, autonomy, and relatedness. PLTLW leaders are encouraged to help cultivate each one of these aspects while leading each workshop. This is done through a non-threatening group atmosphere where students are given choices for how they would like to solve problems. Leaders are also taught that their behavior may have a direct correlation to the motivation of the students, such as how they act or what they say in response to a student. By fostering motivation, students will also be more likely to come prepared to the workshop sessions, as well as be willing, active participants.

Watters and Ginns (1997) detail a study on how a trial student assistance program, similar to PLTLW, affected self-efficacy. Self-efficacy is directly tied to motivation, as it is an individual’s belief in his or her ability to engage in an activity
and expect a certain outcome. This study also determined the relationship between self-efficacy, student attitudes, and participation within the program.

The program's student leaders were required to maintain and report a weekly journal, as well as meet regularly with the researchers. The journals showed a frequent reference to how the sessions increased students' confidence in doing assessments, which transferred to an increased motivation for students to prepare for each assessment. The main reason given to the leaders for why students attended the sessions was that the students needed to understand science. It was also noted that some of the students needed to obtain help in order to pass the class. Students who did not participate in the program gave reasons that were mainly due to time constraints or reasons that were affective in nature, such as "I did not want to."

Using a Science Teaching Self Efficacy Belief Instrument taken from an article by Enoch and Riggs (1990), students in a foundation science course were surveyed at the beginning and end of the trial program, as well as at the end of the semester (as cited in Watters & Ginns, 1997). The results of the first survey displayed no significant difference in self-efficacy between students who attended, and those who did not attend the weekly assistance program. However, the following two survey administrations exhibited an increase in the self-efficacy of students who attended the weekly session in comparison to those who did not. The researchers speculate that enhanced understanding gained from the sessions resulted in an improved confidence level, which is directly related to increasing one's self-efficacy.
Woodward, Weiner, and Gosser (1993) also authored an article that details information on motivation obtained from a study dealing with a team-based workshop approach used for a general chemistry course. This study used student surveys on the workshop approach, student evaluations on the workshop leaders, attendance records, and examination grades as the basis for data collection. The surveys demonstrated a strong approval for the workshops, while the workshop leaders received excellent evaluations. A direct correlation between workshop attendance and performance on tests was determined. This proved to be a major extrinsic motivator, and more students began attending and participating as a result.

According to Adamczeski and Fuller (2001), a great means of extrinsic motivation is to offer the PLTLW as "a separate one credit pass/no pass course" (as cited in Arendale, 2005, p.33). Their research focused on the impact with student peer facilitators and the grade achievement of those students participating. They found that the chemistry course grades were better for those enrolled in the PLTLW course as compared to those who were not. It is speculated that this is due in part to the extrinsic motivation of getting a good grade not only in the chemistry course, but also in the one credit course. This study, along with the other references cited, demonstrate that although intrinsic motivation plays a key factor in workshop participation and attendance, the extrinsic benefits are often what motivates students to attend the sessions.
Other Applications

While many of the research studies cited the benefits of PLTLW, there were some research studies performed based solely on the application of PLTLW concepts to the postsecondary chemistry laboratory and lecture hall, as well as the secondary level classroom. These studies were performed based on educators taking advantage of the benefits that can be obtained from both the PLTLW and guided inquiry approaches. Incorporating these concepts into how a professor, graduate assistant, or high school teacher leads their class can greatly benefit the students involved.

According to Roehrig, Luft, Kurdziel, and Turner (2003), “chemistry departments have been challenged to change their approach to teaching” (p. 1206) and have been called to “incorporate scientific inquiry-based experiences into undergraduate laboratory classes” (p. 1206). This study was therefore based solely on incorporating a type of guided inquiry approach similar to PLTLW into the general chemistry laboratory time. With universities where graduate teaching assistants (GTAs) lead the general chemistry laboratory time, it has been up to the staff at these doctoral schools to properly train their GTAs in terms of proper inquiry-based instruction. This includes teaching methods, learning styles, and instructional design.

In the study done by Roehrig, Luft, Kurdziel, and Turner, six GTA volunteers participated in interviews and were observed by the four researchers. The conclusions drawn from this research were that GTAs’ prior inquiry-based experiences as students affected their instructional decisions, they did not have the instructional skills needed in an inquiry-based environment, and GTAs had ill-formed conceptions about how
students learn. Proper training of the GTAs could drastically lessen these effects. These conclusions are not unlike those that may be drawn from a PLTLW format where proper training is a major key to the success of PLTLW leader and student interaction.

Incorporating PLTLW concepts and formatting to an undergraduate laboratory setting, as was done for the GTA research, has not been the only modification made within college chemistry courses. A semester-long chemistry course where a guided inquiry approach is used within the college lecture hall has been studied by many researchers. In the two cases discussed here, the recommended arrangement would consist of approximately two thirds lecture and one third workshop-based instruction (Herreid, 2003; Lewis & Lewis, 2005).

According to Herreid (2003), students can be graded both individually and as a group within this format. This set-up not only improved attendance, but also was shown to improve retention with students performing better on assessments. There was also a greater sense of personal satisfaction reported by the students.

In a study performed by Lewis and Lewis (2005), the PLTLW scenario was adapted for smaller groups of three to four students and termed as “peer-led guided inquiry (PLGI)” (p.135). A control and experimental class were chosen. The control remained in a strictly lecture format while the experimental class received the two thirds lecture and one third workshop-based instruction format. The scores on four exams and the final exam were then compared to determine if the PLGI approach was effective in improving student grades, confirming that students learn more and retain
it better in this format. As suspected, the performance was better in the experimental class. The data collected actually showed that "the difference in performance between the two sections became larger as the course progressed" (p. 136). This is believed to have been a result of the progressive impact of the PLGI session. As students are further exposed to and gained greater experience with this method, it would be expected that the students would benefit more. Comparison of student SAT and ACT scores showed that the average scores were approximately the same for both the control and experimental classes. This helped to affirm that student success was due to the PLGI method, and not the individual students participating in the study. These conclusions can be adapted to the PLTLW model, where consistent involvement is necessary for greater student performance to be achieved.

The PLTLW model has begun to be implemented on the secondary level due to its success at the postsecondary level. Cracolice and Deming (2001) believe that the PLTLW approach is actually more beneficial to high school students than the typical cooperative learning strategy that many science teachers at this educational level are told to use. This is because in cooperative learning, the teams do not have leaders. Leaders are needed in order to help the team properly function. The teacher chooses team leaders to train and creates the workshop materials. Workshops are held once a week, typically for a 45-60 minute length of time. With this approach, "students are more likely to honestly express their ideas - both scientifically valid conceptions and misconceptions - in a peer group where they have no fear of looking stupid in front of a teacher who will be issuing grades" (p.22).
The challenges encountered in the high school PLTLW approach are quite similar to those encountered at the college level. The greatest challenge is finding peer leaders. With more strict scheduling on high school students, it is much more difficult to correlate more advanced students’ schedules so that they are able to lead a workshop once a week for a class that they had already previously mastered. Other challenges include the training of the selected leaders, as well as choosing appropriate materials that will be completed during the PLTLW session.

Regardless of the PLTLW format chosen or the educational level of the participants, the same results have been obtained. Students and leaders alike benefit from PLTLW. This contributes to the overall effectiveness of the PLTLW program.

Summary

The overall consensus is that what makes the PLTLW program effective is the dedication of both the participating students and the leaders.

Unless participants maintain a clear vision and commitment to the Workshop method, there is a danger that the program might regress to something more familiar and easier to maintain...but less effective than the workshops. The ongoing discussion of the PLTL dynamics is healthy and should eventually lead to a better understanding of how to make the workshops more effective (Gafney, 2000, p. 11).

As long as leader training includes the teaching and practice of the principles of pedagogical content knowledge and classroom knowledge, and students are motivated
and prepared to learn and interact with their peers, then both leaders and students will find the PLTLW approach worthwhile and effective as a team-based learning program.
Chapter Three: Applications and Evaluation

Introduction

The target group for this study was composed of those who voluntarily participated in the Peer-Led Team Learning Workshop sessions for a general chemistry course at SUNY Brockport, as well as those who led each session. The goal of this study was to monitor the PLTLW approach in terms of the effectiveness of leader training, how leaders are affected in their role of the PLTLW program, the effectiveness of teaching problem-solving skills, and the effectiveness of increasing student motivation within the chemistry course. Through observations and the data collected, the PLTLW program being implemented may be adjusted in order for optimal results to be obtained for both the students and the PLTLW leaders involved. The demographics of those involved with the study, as well as how the aforementioned objectives were achieved through data collection, will be discussed within this chapter.

Participants

The study of PLTLW effectiveness was influenced by the demographics of those participating. All student participants were enrolled in CHM 206, the spring semester 2006 general chemistry course at SUNY Brockport. Specific demographics such as socioeconomic status, race/ethnicities, and special needs/disabilities found within the PLTLW groups are unknown, as they were not reported for results and were not specifically noted. The major demographic of note is that all participants, both students and leaders, were female. No males participated in the study. There
were a total of eight female students that participated in each of the testing instruments used. This was the total number of students who attended the PLTLW sessions during the weeks with which I collected data. This was a disappointing amount of students, since over 100 students were enrolled in the CHM 206 course. Unfortunately, PLTLW attendance had been steadily decreasing since the beginning of the spring semester.

As one of the four PLTLW leaders, I am a middle-class, Caucasian female in good academic standing. My previous experiences in student assistance programs include chemistry tutoring, six semesters as a Supplemental Instruction leader for general chemistry courses at my undergraduate institution, and fall semester 2005 PLTLW leader at SUNY Brockport for CHM 205, the prerequisite for CHM 206.

Procedures of Study

In order to study the effectiveness of PLTLW based on the four questions posed, data was collected by means of an observational journal, as well as a total of four testing instruments. The observation journal entries were based on my experiences as a PLTLW leader within a three-month time frame. At the conclusion of each PLTLW session that I led, I wrote down any applicable thoughts relating to the success of the current PLTLW arrangement. Over the course of the three-month period, I had three different students participate, with one of these students only attending one time. All three attendants were female students. For the majority of the three months, I found myself doing one-on-one tutoring with a student who consistently attended.
The questionnaires and surveys were administered to both the participating students and PLTLW leaders within a four to six week time period during spring semester 2006. Each participating student and PLTLW leader completed a questionnaire (see Appendices C and D) as well as a survey (see Appendices E and F) designed specifically for their role within the PLTLW format. The student questionnaire and survey were administered at two times during each of SUNY Brockport’s four PLTLW sessions. The PLTLW leader questionnaire and survey were administered at two times during the PLTLW leader training sessions. There were a total of four female PLTLW leaders, all of whom participated in each questionnaire/survey. One of these leaders did not attend the training sessions, and therefore completed her testing instruments during her PLTLW session while I administered the student instruments.

**Instruments for Study**

The observational journal that I kept was one form of data collection for this action research project. Any observations I made pertaining to student performance, student motivation within the workshop session, my performance as a leader, and how I believed leader training prepared me for each week’s session were recorded in this journal. Observations from this journal were later compared so that proper analysis and conclusions could be made.

The four testing instruments used were composed of a questionnaire and survey for the PLTLW-participating students, as well as a questionnaire and survey for the PLTLW leaders. These questionnaires and surveys provided information on
1) student performance, 2) student motivation for attending PLTLW, 3) leader performance, and 4) effectiveness of leader training. Both the student and PLTLW leader questionnaires were adapted from Tenney and Houck (2004). The questionnaires used a five-point Likert scale. I created the student and PLTLW leader surveys based on the research objectives. The student and PLTLW leader surveys also had questions that required the five-point Likert scale, however these surveys also asked for responses to open-ended questions. All questionnaires/surveys were completed voluntarily and anonymously.

Summary

Eight female students participated in the PLTLW sessions, with four female PLTLW leaders facilitating these sessions. One of the leaders did not attend the leader training sessions. I kept an observational journal to record any of my thoughts pertaining to the research objectives. Both the students and the leaders were given a questionnaire and a survey, for a total of four testing instruments that were in response to each of the research goals.
Chapter Four: Results

The following chapter includes both qualitative and quantitative analysis of collected data from the observational journal I kept, as well as from the questionnaires and surveys taken by the participating students and PLTLW leaders.

The Journal

The observations within my journal seemed to focus primarily on student performance. These notes included consistent student comments on their lack of comprehending lecture notes. A typical PLTLW session therefore began by reviewing students’ lecture notes and answering questions pertaining to concepts and calculations within these notes. One observation I had written was “They [the students] typically know exactly what areas they are struggling with and what they want further help with. They will ask questions when they get ‘stuck’.” Another hindrance to student performance within CHM 206 was the obvious lack of necessary mathematical skills. One example was a student’s revelation as I was explaining the Clausius-Clapeyron equation, in which she stated “I wondered what ‘ln’ was!” in reference to “ln”, the natural log function. Many mathematical problems were mainly algebraic in nature. For example, two participants did not know how to solve for mass by using volume and density information.

I found that content clarification received within the leader training sessions sometimes helped me as a leader in explaining various concepts to the participating students. Since PLTLW leaders do not receive an answer key to the workbook questions, the training became a supplement in making sure that we had started each
problem correctly. This also ensured that correct procedures and responses were available while directing students.

As far as facilitating the learning process with students, I typically would ask for students to give their thought process in solving a problem. I would also offer different strategies for remembering a concept whenever possible. These are examples of skills not taught in PLTLW leader training, since training only consisted of information within a content-based realm. Rather, these are skills I have gained from my experiences within an educational field.

The Questionnaires

The student questionnaire (Appendix B) consisted of eleven statements that students were asked to check off whether or not they disagreed, had no opinion, or agreed with the statement. These responses were then given a numerical value to determine statistical data. Disagree was given the value 1.0, no opinion was 2.0, and agree was 3.0. The average and standard deviation for each question’s response can be found in Table 1.
Table 1

*Average Responses to the Student Questionnaire*

<table>
<thead>
<tr>
<th>Question</th>
<th>Average</th>
<th>Standard deviation</th>
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*Note.* The average responses to each statement of the student questionnaire are given with their corresponding standard deviations. 1.0 = disagree, 2.0 = no opinion, 3.0 = agree.

Questions #1, 8, 9, 10 were in response to the research question “What is the effect of proper leader training?” Question #9 also was indirectly related to the question “How does PLTLW affect the leaders?” Questions #3 and 7 dealt with the research question “What are the effects of teaching problem-solving skills?”
majority of the questions, #2, 4, 5, 6, 7, and 11, were in response to the research question "Does PLTLW increase student motivation within the chemistry course?"

The averages and standard deviations given in Table 1 show that all students responded in the same fashion for questions #1, 6, 7, 9, and 10. Students therefore feel that they are comfortable in asking questions, they would recommend PLTLW to other students; the workshop materials are well connected with the lectures; the workshop leader helps to increase their knowledge of chemistry content, the workshop leader is well-prepared, and the workshop leader is effective in facilitating the workshop.

Questions #5 and 11 deal with participant interaction and attending workshops. These yielded responses close to the agreement mark, but not exact. While workshop attendance is not something a PLTLW leader can help, achieving full participant interaction is perhaps an area with which leaders need to be further trained.

The responses to questions #3, 4, and 8 hover above the "no opinion" category due to 25% of the surveyed population being in disagreement with the given statement. I believe this to be a significant amount, and therefore believe it is important to bring attention to the fact that students do not believe that the workshops are improving their course grades, they do not readily explain problems to their fellow students, and they feel as though noises and distractions hinder the workshop experience. If students do not believe PLTLW is improving their grades, then what is their motivation for attending the PLTLW sessions? Likewise, if students are not
readily explaining problems to their peers, then they are not exercising higher
cognitive levels. The latter is an educational tool that perhaps needs to be discussed
with the PLTLW leaders, within the realm of the leader training sessions. Distractions
from other students within the PLTLW session are also an area that can be curbed
through proper leader training.

The PLTLW leader questionnaire (Appendix B) consisted of fifteen
statements that leaders were asked to check off whether or not they disagreed, had no
opinion, or agreed with the statement. These responses were then analyzed in the
same fashion as those for the student questionnaire. The results can be viewed in
Table 2.
Table 2

*Average Responses to the PLTW Leader Questionnaire*

<table>
<thead>
<tr>
<th>Question</th>
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*Note.* The average responses to each statement of the PLTW leader questionnaire are given with their corresponding standard deviations. 1.0 = disagree, 2.0 = no opinion, 3.0 = agree.
Questions #5, 6, 7, 9, 10, 11, and 14 were in response to the research question "What is the effect of proper leader training?". Questions #1, 8, 11, and 15 were related to the question "How does PLTLW affect the leaders?". Questions #6 and 7 dealt with the research question "What are the effects of teaching problem-solving skills?". The majority of the questions, #2, 3, 4, 6, 7, 10, 12, and 13, were in response to the research question "Does PLTLW increase student motivation within the chemistry course?"

The averages and standard deviations show that all PLTLW leaders responded in the same fashion for questions #1, 5, 6, 7, and 14. Leaders therefore feel that being a leader increases their understanding of chemistry; they regularly explain problems to students, they would recommend workshop courses to students, students are generally comfortable in asking questions within their workshop, and interacting with other workshop leaders is helpful.

Questions #4 and 14 yielded slightly lower scores that indicate workshops may not necessarily improve student grades and the workshop leaders may be acting more as a teacher rather than a facilitator. If students are not getting better grades, then what would motivate them to come to PLTLW? Also, if leaders are acting more as a teacher than a guide, then they are not following the PLTLW model and therefore need further training in order to enforce this objective.

Questions #2, 9, and 10 address the following: connection between workshop material and lectures, distractions within the workshop, and unmotivated students making it difficult for others to benefit from the workshop. These results hover about
the "no opinion" mark, similar to the results obtained for comparable questions within the student questionnaire. One difference, however, is that students fully agreed that workshop materials were well-connected to the lectures, while the leaders do not believe this to be true. If workshop materials are not connected to what is taught in the lectures, then what would be the students' motivation to attend PLTLW?

Questions that lean more toward the disagreement end with the PLTLW leaders are #3, 8, 12, 13, and 15. Workshop groups typically do not schedule extraneous meetings before tests, the lecturer does not show interest in the workshop leaders, the workshop materials are not demanding and offer minimal preparation for the tests, students are not well-prepared for workshops, and the training on how to conduct workshops is not as helpful as it should be. While the responses to questions #3 and 8 are not as pressing, the responses for the other three questions are quite important. It might be considered a waste of time to attend workshops that lack challenging materials and proper preparation for the tests. Students may not be prepared for workshops because they lack the motivation to work on chemistry outside of lecture or the PLTLW. Also, many students find it a waste of money to purchase the PLTLW workbook. Students must therefore wait for the workshop day in order to receive photocopies that they have not previously viewed. Lastly, if PLTLW leaders do not believe that training sessions are fruitful, what can be done to change them and make them more beneficial?
The Surveys

The student survey (Appendix C) included four statements that students were asked to circle whether or not they disagreed, had no opinion, or agreed with the statement. These responses were then given a numerical value to determine statistical data. These were ranked with strongly disagree given the value 1, disagree given the value 2, no opinion was 3, agree was 4, and strongly agree was 5. The results, as well as the average and standard deviation for each question's response, can be found in Table 3.

Table 3

Average Responses to the Student Survey

<table>
<thead>
<tr>
<th>Question</th>
<th>Average</th>
<th>Standard deviation</th>
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<tr>
<td>1</td>
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Note: The average responses to each statement of the student survey are given with their corresponding standard deviations. 1.0 = strongly disagree, 2.0 = disagree, 3.0 = no opinion, 4.0 = agree, 5.0 = strongly agree.

Questions #1 and 2 relate to the research question “Does PTLTW increase student motivation within the chemistry course?” whereas question #3 corresponds to the research question “What are the effects of teaching problem-solving skills?” and
question #4 to "What is the effect of proper leader training?" As one can observe from the given averages and standard deviations, the majority of the students agree, with small deviations, that they are well-prepared for each workshop; they regularly attend workshops; their problem solving skills have benefited, and they are satisfied with the format of each session. The reasoning behind these responses can be further explored by analyzing student responses to the open-ended question portion of the student survey.

There were five questions asked of the students in an open-ended format. The first question asked was how students prepared for each workshop session. Preparation is related to the motivation portion of the action research project. The majority of responses were centered about bringing proper materials, such as their textbook, notebook, and calculator. One student, however, demonstrated her preparation for workshop by stating that "I pay attention in lecture for any questions that I may have, and then I ask them in workshop. Also, if there are lab calculations, or concepts in general that I do not understand, I will ask them in workshop."

The second open-ended question hinges on the main purpose of why students attend workshops, or their foremost motivation for doing so. The majority of students declared that they attend because they wanted "to do better", whether on tests or in the class in general, by means of achieving higher grades. Students also mentioned that they wanted to "better understand" the chemistry content. One student said they attend workshops "because I feel the material is better explained in workshop than in class."
The responses to the third question of what students enjoy most about workshop included statements that related to both the teaching of problem-solving skills as well as how PLTLW affects the leaders. One comment made was that “I enjoyed interacting with the other students and the workshop leader in solving problems. I also enjoyed the personal atmosphere of the workshop.” It is obvious from this statement that the social network formed easily lends itself to various methods of problem-solving. Leaders should be pleased with the fact that students are grateful for the rapport created.

The fourth question asked what students would do to change the way the workshops are organized. Half of the students responded by saying that nothing needs to be changed. Other comments that were made centered around proper training of the PLTLW leaders. Two students responded by saying that they believe they benefit more from smaller groups of three to five students rather than a larger group. One comment stated that there needed to be “better control from [the] team leader.” Another student replied by saying that more problems needed to be done from the textbook instead of the workbook. Yet another student said that there needed to be a better connection between the workshop and the lecture hall.

The fifth and final question asked for any further comments or suggestions. Two students did not give a response, yet a couple of students mentioned again about how workshops increase “one’s understanding of chemistry” and also helps “to build one’s social network.” Other students made comments and suggestions directly related to the research questions. One student mentioned how workshops were
improving her course grades. Two students gave possible suggestions for improving PLTLW and increasing student motivation. One of these students said that having "work problem worksheets" to help with the problem-solving process would be beneficial. Another student responded, "I feel that the students that regularly attend the workshop should get some type of extra credit points." This proves that perhaps students need more of an extrinsic, rather than intrinsic, motivation in order to attend and participate in the workshop sessions.

The PLTLW leader survey included five statements that the leaders were asked to circle whether or not they disagreed, had no opinion, or agreed with the statement. These responses were then analyzed in the same fashion as those for the student survey. The results can be viewed in Table 4.

<table>
<thead>
<tr>
<th>Question</th>
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<th>Standard deviation</th>
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<td>5</td>
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*Note.* The average responses to each statement of the PLTLW leader survey are given with their corresponding standard deviations. 1.0 = strongly disagree, 2.0 = disagree, 3.0 = no opinion, 4.0 = agree, 5.0 = strongly agree.
Questions #1, 2, and 3 relate to the research question "What is the effect of proper leader training?" Question #4 deals with the research question "How does PLTLW affect the leaders?" and question #5 corresponds to "Does PLTLW increase student motivation within the chemistry course?" PLTLW leader responses were all fairly agreeable for questions #1, 4, and 5. Leaders therefore agree that they are well prepared to lead each workshop, their problem-solving skills have benefited from being a PLTLW leader, and problem-solving skills are something each leader strives to teach in each workshop. Responses to questions #2 and 3 are evidence of lackluster training sessions. The majority of the leaders have no opinion as to whether the leader training sessions help to prepare them for each workshop session. Leaders also hold no opinion as to whether or not they receive content clarification within each training session. If content clarification is the only thing that leaders are being trained for, and they hold no opinion as to its affect on their workshop preparation, then perhaps training needs to be adjusted to make it more worthwhile.

The second portion of the PLTLW leader survey was composed of five open-ended questions. The first question asked for problems that the leaders have encountered by being a workshop leader. Five comments were made as to the lack of attendance, participation, or student interest. Three comments were made in response to the workshop material not corresponding to lecture or being comprised of occasional "awkward questions." These eight comments all correspond to the research question "Does PLTLW increase student motivation within the chemistry course?" since the lack of student motivation may be in part to poor correlation
between the workshop workbook and lecture content. One comment was also made that "adjusting to a large range of learning styles" had been difficult in the past. This is a topic that could be further explored in a training session, and therefore relates to the research question "What is the effect of proper leader training?"

The second open-ended question was purposefully asked with the research question "What is the effect of proper leader training?" in mind. This question asked the PLTLW leaders what activities or topics would they like to see covered in the training sessions in order to better prepare them for leading workshops? While one person did not respond and another simply put "I don't know", the comments from the other two leaders included "key difficulties students have been facing in the class", "more 'how' instead of 'what' to lead", and further information on what students are doing currently in the laboratory portion of the course because "they may have questions and [it] contributes to success in the course." Only one of these comments could be interpreted as wanting more educational training rather than content training.

The responses to the third question of why the leaders believe students attend the workshop sessions were mainly based on understanding lectures, getting practice on what the students have learned, and improving student grades. One comment was made that it was the "only time they work on chem outside of class." Another leader mentioned that "the ones who are attending are the motivated ones who want to understand the material more thoroughly." If this is the case, then how can PLTLW be structured to reach the students who still lack the foundational understanding
needed to achieve success within the course? These comments center on how to use PLTLW as a tool to increase student motivation within the course.

The fourth question was asked to obtain a better understanding of the leaders' past educational leadership roles. The answers to this question could help to form what educational training may be necessary. The leaders possessed a variety of educational experiences, with each leader having had tutored before, as well as having had participated as a PLTLW leader at least for the fall 2005 semester. Two leaders had been involved with educational coursework, with one having obtained a New York State teaching certificate in chemistry. One of the leaders had been a PLTLW leader for six semesters, and had also been a chemistry teaching assistant for two chemistry courses.

The fifth and final question asked the leaders why they are a PLTLW leader as a means to answer the question “How does PLTLW affect the leaders?” Three leaders responded that they were a leader “to review my general chemistry.” One student mentioned that being a leader was for class credit, one said that it was “because I took workshop”, and yet another leader replied that “I enjoy doing it and helping students learn.” There are therefore a variety of leader benefits within the PLTLW program.

Summary

Students are satisfied with the workshop format. However, they believe that the content within these workshops needs to be reformatted to better correlate with the lectures. Students enjoy the smaller groups of participants and many do not believe that their participation within the workshop helped to improve their course.
grades. The results from the PLTLW leaders show a need for modifying the way
leader training is performed. There were also many benefits that leaders encounter,
including an ability to better retain the chemistry information due to consistent review
and being able to build their social skills by helping others.
Chapter Five: Conclusions and Recommendations

The wide range of data collected yielded many possible implications for the Peer-Led Team Learning Workshop format at SUNY Brockport. In the following chapter, I will discuss the conjectures I made based on the analysis of the data collecting instruments. These conclusions helped to form an action plan for the improvement and modification of the current PLTLW arrangement. An action plan is not beneficial without reassessing the changes that have been made. Therefore, recommendations for future research have been given to determine whether or not the modifications made improved the PLTLW experience for all parties involved or not.

Discussion

Students are satisfied with the workshop format; however, it is what occurs within this format that needs to change. Students tend to prefer the smaller groups of three to five students rather than the recommended six to eight student groups. The majority of the students and leaders do not believe that workshop participation is improving the students' course grades. Perhaps grades are not increasing because the majority of the students who attend the workshops are the motivated students who already receive good grades. This also may be in part because the participating students are not regularly explaining the problems they understand to their fellow peers. By using higher cognition levels in explaining concepts, students are able to achieve greater retention of the chemistry material and therefore receive improved course grades as a result.
The workshop materials do not always correlate with the lecture materials. This is therefore a part of the workshop that is in desperate need of modification. The leaders agree with these statements, while students agreed with these statements in the survey and not the questionnaire. This may be due to the differing chemistry units that were being discussed at the time each testing instrument was administered.

Many students believed that they were prepared for PLTLW simply because they brought materials such as their textbook, notebook, and calculator with them to the workshop. Although it is good that they brought these materials with them, this type of preparation does not substitute for reviewing concepts and determining what one wants to specifically accomplish within the PLTLW session.

PLTLW leader training is also in need of modification. PLTLW leaders hold no opinion on the training. This does not mean it is terrible, but it does not mean that training is very good either. The methods of training are in need of change so that the leaders can firmly state that they found PLTLW training to be beneficial to their PLTLW experience. While content clarification is needed within each training session, it should not be the sole priority.

Revealed in this action research were also the great effects PLTLW has on the leaders. The main benefit was that PLTLW allowed a consistent review of chemistry and therefore helped the leaders to retain this information. Leaders enjoy being leaders and some feel that their previous experiences as a PLTLW student is what makes them strive to also be a good leader. Class credit and/or payment are also benefits, since none of the leaders are volunteers. Finally, leaders benefit from the
greater development of their social skills through the rapport they build with the participating students and fellow leaders.

Action Plan

One recommended action for the dilemma concerning workshop and lecture material reciprocity would be to create workshop materials that better correlate with the lecture. A greater correlation with lecture may actually cause an increase in student participation, and therefore an increase in student motivation as well. Some student suggestions for workshop materials included using more problems from the textbook and using worksheets that focus on developing problem-solving skills within each unit. By creating the workshop materials, SUNY Brockport chemistry faculty could also concentrate more on their students' learning and mastering the necessary math skills needed to be successful in the chemistry classroom. These materials could also make lecture notes more comprehensible and provide the necessary connection between the lecture and the laboratory.

Creating the workshop materials could also help in student preparation. Doing this would make it possible for students to have the materials to look over prior to their workshop session. Even if workshop materials were not created, the photocopies of the workbook could be made and distributed in the week prior to that unit's workshop. Leaders would need to make sure to tell the students what is expected of them in the realm of PLTLW preparation within the first few weeks of the semester. By following these recommended actions, PLTLW would more than likely become a tool for increasing student motivation within the chemistry classroom.
Another means of achieving student participation would be to provide extrinsic motivators, instead of only intrinsic ones. This could be done by means of giving extra credit for attendance and participation in PLTLW. This undoubtedly would create greater PLTLW participation, greater retention rates, and improvements in course grades as a result. This was actually the method used in the Supplemental Instruction approach that I led at my undergraduate institution. While there were typically just over 20 students enrolled in the chemistry course, the attendance was approximately 25-50% of the class during any given weekly session.

Some suggestions given by both the PLTLW leaders and the students include training the leaders in how to cope with a variety of learning styles in each workshop, act more as a facilitator or guide rather than a teacher, minimize distractions within each workshop session, obtain maximum participant interaction, and still maintain control of the workshop. While all of the PLTLW leaders had experience in educational settings; this does not guarantee that they were properly trained at any point. It is up to the leader trainer to ensure that all PLTLW leaders receive proper training not only in the field of chemistry, but also in the field of educational concepts.

Since this is my last semester of participating in the PLTLW program, the responsibility for the recommended actions to be implemented falls on SUNY Brockport’s chemistry department. More specifically, next semester’s PLTLW leader trainer/advisor and the PLTLW leaders will carry the most responsibility. In order for this to occur, the chemistry professors and PLTLW leader trainer will need to be
informed of the findings of this action research study and what needs to be done to make PLTLW a success. These persons will also be responsible for monitoring and collecting the effects of the actions. The recommended actions and monitoring will not be able to occur until the CHM 206 course begins in the spring 2007 semester. I believe a great resource that would benefit the PLTLW program would be to include learning center specialists or the Education and Human Development department in the PLTLW leader training sessions. There will also need to be a closer connection and/or better communication between the leader trainer and the chemistry lecture and laboratory professors. If workshop materials were to be created, this would most likely be left up to the chemistry professors and leader trainer. However, it may be a good idea to utilize a higher-level chemistry education major to create the workshop materials as a means to receive course credit.

Recommendations for Future Research

Once the suggestions within the action plan have been followed as deemed feasible by the faculty and PLTLW leaders responsible, research will again need to be undertaken to review the effectiveness of the revised PLTLW approach. The surveys and questionnaires may again be distributed to all participating students and PLTLW leaders. These results would then need to be compared to the original data as a means of monitoring the progress of the PLTLW model. Something worthy of noting would be that the student sample and PLTLW leaders change from year to year, and could have a slight impact on the newly obtained results.
In addition to surveying the original parties involved, perhaps the scope of the research should be broadened to include the surveying of general chemistry faculty and students who do not participate in the PLTLW sessions. Surveying the chemistry faculty would help to determine how effective they believe the PLTLW approach is in comparison to how it was in the past. Surveying students who do not participate in the PLTLW sessions would aid in determining the main source of student motivation to attend the workshops.

I would also recommend that the literature be reviewed and shared in order to update those involved on the more recent suggestions and present-day research dealing with the effectiveness of the Peer-Led Team Learning Workshop student assistance program in comparison to other models. After monitoring the new data and research, adjustments may be made once again in order to strengthen the program and make it most effective and beneficial for all persons involved.

Conclusions

PLTLW leaders have received more benefits from the student assistance program than have the students. PLTLW leader training must be improved so that the leaders are not only refreshing themselves in terms of the content, but they are also taught the proper educational pedagogy so that the sessions are properly guided. The PLTLW materials are in need of modification for better correlation with lectures. Once this has been done, it will be more likely that students will be intrinsically motivated to attend the workshops. Extrinsic motivators, such as extra credit, may need to be used for greater student participation. Overall, the Peer-Led Team
Learning Workshop approach as a student assistance program for general chemistry students has shown to be effective if implemented correctly, with an efficient and consistent process of monitoring and adjusting.
References.


Appendix A: Student Consent Form

Statement of Informed Consent

Dear CHM 206 student,

For the next 4-6 weeks I will be conducting research in the Peer-Led Team Learning Workshops (PLTLW) in affiliation with SUNY Brockport and the Department of Education and Human Development for completion of my Master's degree. The goal of this research is to determine the effectiveness of the PLTLW in the aspects of student performance and motivation. If you choose to participate, you will be asked to fill out 2 questionnaires/surveys that will assess your performance and motivation within the CHM 206 class.

Please understand that:

1) Your participation is voluntary and you have the right to refuse to answer any questions.

2) Your confidentiality is guaranteed. Your name will not be included in any of my research results.

3) There will be no anticipated personal risks or benefits because of your participation in this project.

4) Participating or not participating in the project will not impact your grade in CHM 206.

5) Your participation involves completing 2 questionnaires/surveys, which will ask questions concerning performance and motivation throughout the course.

6) The results of my research surveys will be used in a research paper for completion of my graduate studies. Again, your name will not be included in this research paper.

7) When the project is completed, all consent forms and surveys will be destroyed.

Please sign below to indicate that you: (1) have read and understand the above statements, (2) agree to participate in the research surveys, and (3) are 18 years old or older. You may change your mind and withdraw from the study at any time. If you have any questions, please do not hesitate to contact Stacy Hooker at 590-0723 or my faculty advisor, Dr. Scott Robinson, at 395-5547.

Please print your name: ____________________________________________
Appendix B: PLTLW Leader Consent Form

Statement of Informed Consent

Dear PLTLW Leader,

For the next 4-6 weeks I will be conducting research in the Peer-Led Team Learning Workshops (PLTLW) in affiliation with SUNY Brockport and the Department of Education and Human Development for completion of my Master's degree. The goal of this research is to determine the effectiveness of the PLTLW in the aspects of student performance and motivation. If you choose to participate, you will be asked to fill out 2 questionnaires/surveys that will assess your performance as a leader, the effectiveness of leader training, and the performance and motivation of student participants within the CHM 206 class.

Please understand that:

1) Your participation is voluntary and you have the right to refuse to answer any questions.

2) Your confidentiality is guaranteed. Your name will not be included in any of my research results.

3) There will be no anticipated personal risks or benefits because of your participation in this project.

4) Your participation involves completing 2 questionnaires/surveys, which will ask questions concerning your performance as a leader, the effectiveness of leader training, and the performance and motivation of student participants throughout the course.

5) The results of my research surveys will be used in a research paper for completion of my graduate studies. Again, your name will not be included in this research paper.

6) When the project is completed, all consent forms and surveys will be destroyed.

Please sign below to indicate that you: (1) have read and understand the above statements, (2) agree to participate in the research surveys, and (3) are 18 years old or older. You may change your mind and withdraw from the study at any time. If you have any questions, please do not hesitate to contact Stacy Hooker at 590-0723 or my faculty advisor, Dr. Scott Robinson, at 395-5547.

Please print your name: ____________________________
Appendix C: Student Questionnaire

**Student Questionnaire**

Please check (✓) whether or not you agree, disagree, or hold no opinion with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree</th>
<th>Disagree</th>
<th>No Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Interacting with the workshop leader increases my understanding of chemistry.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) The workshop materials are well connected to the lectures.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) The workshops are improving my grade.</td>
<td></td>
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<td></td>
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<tr>
<td>4) I regularly explain problems to other students in the workshops.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Interacting with other group members increases my understanding of chemistry.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6) I would recommend workshop courses to other students.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) In the workshops, I am comfortable asking questions about material I do not understand.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9) Noise or other students do not distract me during my workshops.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10) The workshop leader is well prepared.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11) The workshop leader is effective in leading the workshop (i.e. – he/she facilitates the answering of workshop questions and does not simply answer the question for you)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12) I regularly attend a workshop.</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

PLTLW Leader Questionnaire

Please check (✓) whether or not you agree, disagree, or hold no opinion with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree</th>
<th>Disagree</th>
<th>No Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Acting as a workshop leader increases my understanding of chemistry.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) The workshop materials are well connected to the lectures.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) My workshop group sometimes has extra meetings to prepare for tests or to review difficult material.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) I believe that the workshops improve student grades.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) I regularly explain problems to students in the workshops.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6) I would recommend workshop courses to other students.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) In the workshops, students are generally comfortable asking questions about material they do not understand.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8) The lecturer shows an interest in me as a workshop leader.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9) Noise or other distractions sometimes make it difficult to benefit from the workshops.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10) Students who are uninterested or unmotivated make it difficult for others to benefit from the workshops.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11) Interacting with other workshop leaders is helpful.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12) The workshop materials are demanding and are good preparation for the tests.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13) Students are generally well prepared for the workshops.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14) As a workshop leader, I act more as a guide than a teacher.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15) The training that I have or am receiving on how to conduct workshops is helpful.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Appendix E: Student Survey

**Student Survey**

Please circle the number that best ranks your response to the following statements on a scale of 1 to 5, with 1 being strongly disagree and 5 being strongly agree.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

1) I am well prepared for each workshop session.

2) I regularly attend a workshop.

3) My problem-solving skills have benefited from attending the workshops.

4) I am satisfied with the format of each workshop session.

**Answer each of the questions that follow to the best of your ability. Please be specific and honest!**

1) How do you prepare for each workshop session?

2) Why do you attend the workshops? (What is your main purpose for attending?)

3) What do you most enjoy about the workshop you attend?

4) If there was something you could change in the way workshops were organized, what would you change? (i.e. – workshop format, more thorough content coverage, the ways in which the leader facilitates the workshop, etc.)

5) Please give any other comments or suggestions that you feel would benefit my research process.
Appendix F: PLTLW Leader Survey

PLTLW Leader Survey

Please circle the number that best ranks your response to the following statements on a scale of 1 to 5, with 1 being strongly disagree and 5 being strongly agree.

<table>
<thead>
<tr>
<th>Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disagree</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>Disagree</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>No Opinion</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>Agree</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>Strongly</td>
</tr>
<tr>
<td>Agree</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

1) I am well prepared to lead each workshop session.
   1 2 3 4 5

2) PLTLW leader training sessions help me to be well prepared for each workshop session.
   1 2 3 4 5

3) I receive content clarification within each training session.
   1 2 3 4 5

4) My problem-solving skills have benefited from being a PLTLW leader.
   1 2 3 4 5

5) Problem-solving skills are something I strive to teach in each workshop.
   1 2 3 4 5

Answer each of the questions that follow to the best of your ability. Please be specific and honest!

1) What are some of the problems you have encountered as a PLTLW leader?

2) What types of activities and/or topics would you like to see covered in the training sessions to better prepare you for leading the workshop? (These do not need to be strictly content-based.)

3) I believe the main reason students attend the workshop session is .... (i.e. – What is their motivation?)

4) Do you have previous experience in an educational/teaching setting? If so, please list the experience you have (i.e. – previous PLTLW leader, tutoring, educational courses).

5) Why are you a PLTLW leader?